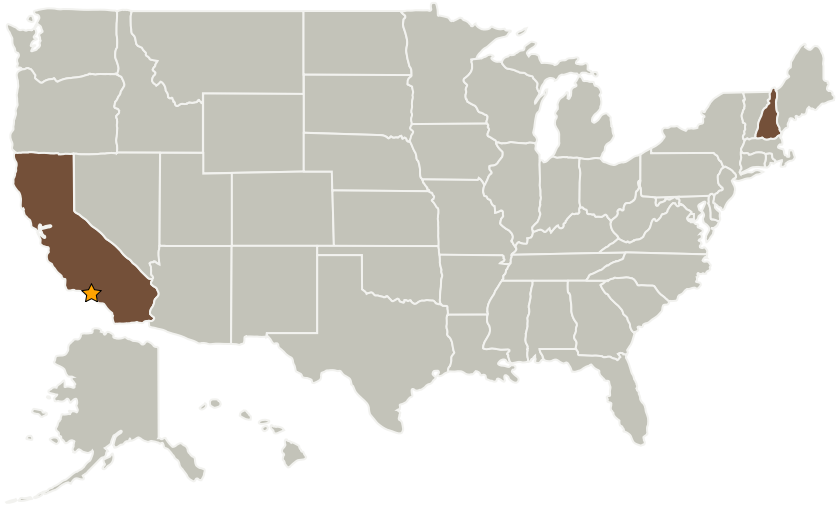
GaAs JFETs for Extremely Low-Noise, Deep Cryogenic Sensor Readout, Phase I

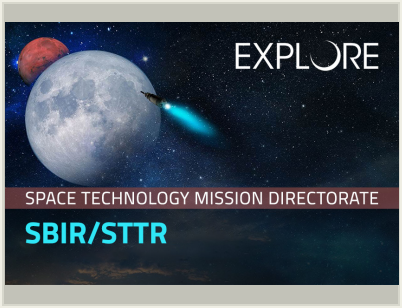
Completed Technology Project (2008 - 2008)

Project Introduction

Ultrasensitive sensors used in NASAs scientific missions (for example infrared sensors) typically require operation at deep cryogenic temperatures for optimum performance. However, to make full use of their performance requires an ultralow-noise preamplifier co-located in the same, or a nearby, cryogenic environment at liquid-helium (~1-4 K) or sub-Kelvin temperatures. A severe impediment to making such preamplifiers is the lack of a semiconductor device with satisfactorily performance in the liquid-helium range (or even below ~40 K). Past use of Si JFETs (operating at ~80 K or higher) has required awkward work-arounds. More serious is that upcoming missions will employ ever more sophisticated and complex sensor systems. What served in the past will be inadequate. Specifically, Si-based technology will not be adequate for preamplifiers needed for advanced sensor systems in upcoming missions and could become the bottleneck in performance and scientific return. Consequently, we propose to develop GaAs JFETs that can exhibit extremely low noise to the lowest cryogenic temperatures (4 K and lower). Our approach is to fabricate the JFETs specifically for low-noise, deep cryogenic operation and to use a novel, proprietary design for the JFET that avoids factors that contribute to noise generation in standard GaAs JFETs.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
GPD Optoelectronics Corporation	Supporting Organization	Industry	Salem, New Hampshire

Primary U.S. Work Locations	
California	New Hampshire

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Rufus R Ward

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors